

REV	REVISIONS DESCRIPTION	DATE	APPROVED
1	ENG REL PER ERC E0260G	12/6/83	JJA



ENVIRONMENTAL/RELIABILITY ENGINEERING

TEST REPORT

1400XL COMPUTER

PRELIMINARY DESIGN VALIDATION REPORT

ENGINEERING RELEASED

		DRAWN BY	DATE	 <p>Atari, Inc. 30 E. Plumaria Drive San Jose, CA 95134</p> <p> A Warner Communications Company</p>	
NEXT ASSY	USED ON	ENGINEER Terry A. Murto			
<p>NOTICE TO ALL PERSONS RECEIVING THIS DRAWING CONFIDENTIAL: Reproduction Forbidden without the specific written permission of Atari Inc., Sunnyvale, California. This drawing is only conditionally issued, and neither receipt nor possession thereof confers or transfers any right in, or license to use, the subject matter of the drawing or any design or technical information shown thereon, nor any right to reproduce this drawing or any part thereof, except for manufacture by vendors for Atari Incorporated and for manufacture under the corpora- tion's written license, no right to reproduce this drawing is granted or the subject matter thereof unless by written agree- ment with or written permission from the corporation.</p>		ENGINEER B.P. Seymour 11-28-83	TITLE 1400XL Computer Preliminary Design Validation		
		APPROVED J.B. Seymour Nov 29, 83	SIZE A	DRAWING NO. C024673-118	REV 1
		APPROVED K. Aehn 11/29/83	SCALE	SHEET 1 OF 17	

SUMMARY

The hardware audit test results indicate an acceptable unit with the following exceptions:

1. Console ESD evaluation, 11/08/83 memo to Dave Sovey. Three capacitors and cartridge ground to be added for conformance to C021703 ESD Product Specification.
2. Five of six 1400XL power supplies, DV-51220W, failed during life tests. Power supply case temperature was 65 degrees C at room ambient. Re-design of this power supply is in process.
3. Printer hangs up when modem is in operation. (This could be a problem with the Billboard Services that were contacted.)

ENVIRONMENTAL TEST RESULTS:

The following environmental tests were performed with no console failures noted:

1. Temperature Shock Test
2. Sine Vibration Test
3. High Temperature Test
4. Temperature and Humidity Operating Tests
5. Low Temperature Tests

The details of the tests are enclosed and dated 9/30/83 to 10/06/83.

ESD console evaluation indicated the I/O connector and metal cartridge susceptible to ESD. The test summary and corrections are identified in the enclosed 1400XL console ESD evaluation memo dated 11/08/83.

LIFE TESTS:

Six units were operated for approximately one month (10/ 6/83 to 11/07/83) without any console failures. Cumulated 3,829 operating hours as of 11/07/83. Tests performed were as follows:

1. Super Salt Test
2. Modem Test
3. Voice Test
4. Star Raiders Game Cartridge Test
5. Math Loop Test

The problems encountered were as follows:

- 1) Five out of six power supplies failed. Re-design is in process.
- 2) Printer hangs up when modem is in operation. (Problem lies in handshaking with Billboard Services.)



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The life testing will be discontinued since all testing must be repeated on more advanced PCB revisions.

RELIABILITY PREDICTION:

Reference enclosed: Memo to Dave Sovey dated 11/21/83 indicates a console return rate of <5% over the 90-day warranty period. This was confirmed on 10/19/83 at Atari Taiwan by a MTBF demonstration. Further life testing will provide final confirmation of 1400XL failure rate.



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Date Started 10-3-83	Specimen Description 1400X1
Date Completed 10-3-83	Type of Test SINE VIBRATION
Engineer (Signature) H. D. Dugman	Manufacturer
Technician (Signature) H. D. Dugman	Test Specification EEM C061616 (REV 1A) Para. 3.3.2.5.1 (PARTS B & C)

Cycling

Specimen Number	Axis	Time Start	Time Stop	Remarks
1	Z	1147	1202	Resonance noted at 52 Hz - No discrepancies noted
1	Y	1211	1226	Resonance noted at 100 Hz - No discrepancies noted
1	X	1245	1300	Resonance noted at 80 Hz - No discrepancies noted

Note: The cycling was conducted from 5-100-5 Hz at 0.015" DA. Due to space limitations the resonances couldn't be monitored for Q value. No separate resonance search was conducted, the specimen was observed the first cycle for resonances.

Dwell

Specimen Number	Axis	Time Start	Time Stop	Freq (Hz)	Remarks
1	Y	1230	1240	100	No discrepancies noted
1	X	1305	1315	80	No discrepancies noted
1	Z	1324	1334	52	No discrepancies noted



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Date Started 9-30-83	Specimen Description 1400 XL
Date Completed 10-4-83	Type of Test Temperature and Humidity (operating)
Engineer (Signature) J. D. Ongman	Manufacturer
Technician (Signature) J. D. Ongman	Test Specification EEM C061616 (REV. 1A) Para. 3.2.4.4.1

Date	Time	Temp (°C)	Humidity (%RH)	Remarks
9-30-83	1230	Amb	Amb	START Temperature increase on specimen # 2
	1300	45	64	
	1330	45	64	START humidity increase
	1400	45	95	START 96hr. Conditioning
9-30-83	2000	45	95	
10-1-83	0200	45	95	
	0800	45	95	
	1400	45	95	
10-1-83	2000	45	95	
10-2-83	0200	45	95	
	0800	45	95	
	1400	45	95	
10-2-83	2000	45	95	
10-3-83	0200	45	95	
	0800	45	95	
	1400	45	95	
10-3-83	2000	45	95	
10-4-83	0200	45	95	
	0800	45	95	
10-4-83	1400	45	95	Specimen operates Normal

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Date Started		Specimen Description	
10-6-83		1400XL	
Date Completed		Type of Test	
10-6-83		Low Temperature	
Engineer (Signature)		Manufacturer	
J.D. Anzman		Manufacturer	
Technician (Signature)		Test Specification	
J.D. Anzman		EEM C061616 (REV. 1A) Para 3, 2, 3, 4.2	
Specimen	Temp	Time	Remarks
2	Amb	0700	START Temperature decrease
	-30	0830	START STABILIZATION
	-30	0835	
	-30	0840	
	-30	0845	START 4 hour Conditioning
	-30	0945	
	-30	1130	
	-30	1245	START Temperature INCREASE
	10	1400	
	10	1405	
	10	1410	
	10	1415	START 1 hour Conditioning
	10	1445	
2	10	1515	Specimen operates Normal



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Inter Office Memo



Consumer Electronics Division

To: DAVE SOVEY

From: GIL SEYMOUR 

Subject: 1400XL CONSOLE - ESD EVALUATION

Date: 11/08/83

The 1400XL console passed "ESD" susceptibility tests (C021703) with the following design changes incorporated:

- A) Arc's at SIO connector with cable attached.
1. Add 0.001 uf capacitor from J1-11 to ground for elimination of U34 (C-MOS analog mux.) failure at 15KV.
 2. Add 0.001 uf capacitor from J1-1 to ground for elimination of U1 (op-amp) failure at 20 KV.
 3. Add 0.001 uf capacitor from J1-3 to ground for elimination of potential ESD failures.
- B) Arc at Cartridge. O.S. ROM failure at 20 KV, due to cartridge ground clip not having a proper ground return. (Ground return covered by solder mask.)

Providing a proper ground return for the cartridge clip eliminates the "ESD" failure.

The addition of the three (3) capacitors and the ground clip ground return provides a console that will provide customer product satisfaction.

GS/rh

cc: G. Kuczynski
K. Ashton
M. Ellison
B. Knapp



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Inter Office Memo



Consumer Electronics Division

To: Dave Sovey

From: Gil Seymour *GS*

Subject: 1400XL CONSOLE RELIABILITY PREDICTION

Date: 11/21/83

The present 1400XL console predicted return rate is approximately 4.7% over an operating time of 180 hours with no IC burn-in. The basis of this prediction is as follows:

1. Prediction assumptions - Attachment I
2. Return rate summary - Table I
3. Failure rate of components by % contribution - Table II

Further, analysis of component requirements (Attachment II), IC burn-in impact on return rate (Table I) and cost/benefit analysis of IC burn-in (Table III) show the following results:



1. Burn-in of new Freddie LSI for the first six (6) months of production and burn-in of Antic and GTIA per Attachment II. This LSI burn-in provides a 1400XL console predicted return rate of approximately 3.4% over an operating time of 180 hours.
2. Burn-in of Freddie, Antic, GTIA, O.S. ROM and RAMs per Attachment II. This I.C. burn-in provides a 1400XL console predicted return rate of approximately 2.6% over an operating time of 180 hours.
3. The cost/benefit analysis, Table III, for enhanced 1400XL console reliability, based on failure rates, repair cost and in-house burn-in cost indicates LSIs, (Freddie, Antic, GTIA) O.S. ROM and RAMs require burn-in (Method III).

Method III is the most favorable based on a net savings of \$930,000 per million population of the 1400XL console.

Conclusion:

A preliminary prediction conformation was provided by a MTBF demonstration at Atari Taiwan on October 19, 1982. The identified failure rate of approximately 230 failures/million hours of operation indicates a 4.2% return rate over an operating time of 180 hours. This compares favorably with the predicted 4.7% return rate with no IC burn-in.

The 2.6% return rate (Method III) for 180 hours of 1400XL console operation, is achievable provided burn-in and component requirements (Attachment II) are accomplished.



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To further enhance reliability of the console, the following PCB testing can be included:

- o In-circuit test capability or equivalent.
- o PCB burn-in at 55 degrees C for two hours minimum
- o Power on/off cycling, one minute on, twelve seconds off, for the first hour of PCB burn-in.

GS/rh

cc: Gene Kuczynski
Ken Ashton
Bob Knapp
Arieh Strod

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1400XL COMPUTER

ATTACHMENT I

RELIABILITY PREDICTION ASSUMPTIONS

1. Failure rates are due to chance only, and the failure rate is constant.
2. Preliminary production testing and/or burn-in has removed the early failures, and wearout has not begun to occur.
3. Normal average operating temperature of 40 degrees C inside of console.
4. Reliability figures are taken from MIL-217D Handbook.
5. Connections computed by taking all component solder connections x2 to allow for soldered through holes, etc.
6. Any component failures will cause sub-system malfunction since there are no redundant components.
7. Since all reliability figures are based on MIL Spec. parts, and we are using commercial grade parts, the parts failure per million hours is multiplied by a quality factor.
8. Independence among all system elements is assumed unless otherwise stated.
9. Operating time is an average of approximately two (2) hours per day. The total operating time is 180 hours over a warranty period of three (3) months.
10. Cartridge changes per day are a maximum of approximately six (6) cartridges per day.
11. Power on/off cycling is a maximum of four (4) times per day.
12. No design escapes exist.
13. System components less console has a return rate < 0.6% over an operating time of 180 hours.



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ATTACHMENT II

COMPONENT REQUIREMENTS (ELECTRICAL)

Predetermined sampling plans for components may be used when the cost of not 100% testing is justified (one will always receive faulty components, and sampling plans do not reduce failures on the circuit board or in the field).

A) NEW FREDDIE CHIP

1. First six months of production shipments, Freddie will receive a 100% dynamic burn-in at 125 degrees C, with applied voltage of 6.5 volts, for 48 hours prior to test. Devices to be processed through a 100% screen for all functional electrical parameters.
2. After six months of production shipments, devices to be processed through a 100% screen for all functional electrical parameters unless exempted by a predetermined sampling plan.

B) ANTIC, GTIA LSI'S AND O.S. ROM

Devices will receive a 100% dynamic burn-in at 125 degrees C for 48 hours prior to test. Devices to be processed through a 100% screen for all functional electrical parameters.

C) RAM:

Devices will receive a 100% static burn in at 125 degrees C for 48 hours prior to test. Devices to be processed through a 100% screen for all functional electrical parameters.

D) REMAINING LSI'S (4):

Devices to be processed through a 100% screen for all functional electric parameters unless exempted by a predetermined sampling plan.

E) IC (Various MSI, SSI, PAL, Speech and Modem Devices)

ICs to be processed through a 100% screen for all functional electrical parameters unless exempted by a predetermined sampling plan.

F) MODULATOR, OPERATIONAL AMPLIFIER, VOLTAGE REGULATORS AND LINEAR DEVICES

Components to be processed through a predetermined sampling plan for all critical electrical parameters.



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G) POWER ADAPTOR, SWITCHBOX & KEYBOARD ASSEMBLIES

Assemblies to be processed through a 100% screen for all functional electrical parameters unless exempted by a predetermined sampling plan.

H) TRANSISTORS AND DIODES

Simple active devices to be parametrically tested on a 100% basis, unless exempted by a predetermined sampling plan.

I) PASSIVE PARTS (RESISTORS, CAPACITORS, INDUCTORS AND OTHER ELECTRICAL COMPONENTS)

Components shall be sampled for acceptability to predetermined sampling plans.



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TABLE I

UNIVERSAL PLANNING FORM

1400XL CONSOLE
RETURN RATE SUMMARY

	FIRST SIX MONTHS OF PRODUCTION		AFTER SIX MONTHS OF PRODUCTION		MTBF (HOURS)	
	FAILURE RATE	RETURN RATE	FAILURE RATE	RETURN RATE	1ST SIX MOS.	AFTER SIX MOS.
1 METHOD I						
2 NO BURN-IN					3,850	4,370
3 FAILURE RATE (F/10 ⁶ HRS)	260.00	---	229.00	---		
4 RETURN RATE (%)	4.68%	---	4.12%	---		
5 METHOD II						
6 LIMITED BURN-IN						
7 FREDDIE, ANTIC & GTIA					5,260	5,350
8 BURN-IN						
9 FAILURE RATE	190.00	---	187.00	---		
10 RETURN RATE	3.42%	---	3.37%	---		
11 METHOD III						
12 LIMITED BURN-IN						
13 SAME AS METHOD II + 0.S.					6,950	7,080
14 ROM & RAM BURN-IN						
15 FAILURE RATE	143.90	---	141.30	---		
16 RETURN RATE	2.59%	---	2.54%	---		
17 ASSUMPTIONS: SEE ATTACHMENT I						
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Operating Unit _____

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UNIVERSAL
PLANNING FORM

FAILURE RATE OF COMPONENTS BY % CONTRIBUTION	FREDDIE		ANTIC/GTIA		D-RAMS		O.S. ROM 16K x 8 BIT	
	LIMIT B/I	NO B/I	LIMIT B/I	NO B/I	LIMIT B/I	NO B/I	LIMIT B/I	NO B/I
1								
2								
3								
4								
5								
6		2%						
7								
8								
9			2%	13%				
10								
11								
12					16%	19.4%		
13								
14								
15							1.14%	7%
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NOTE: PRIME IMPACT AFTER SIX MONTHS OF PRODUCTION WILL BE THE ELIMINATION OF THE LEARNING CURVE FOR THE FREDDIE CHIP.

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TABLE III

COST/BENEFIT ANALYSIS



UNIVERSAL
PLANNING FORM

LINE NO.	DESCRIPTION	PREDICTION		IN-HOUSE (2) REPAIR COST	IN-HOUSE BURN-IN COST PER UNIT	TOTAL UNIT COST	TOTAL NET SAVINGS PER UNIT
		CONSOLE RETURN RATE	WARRANTY (1) COST/UNIT				
1							
2							
3	METHOD I						
4	(NO I.C. BURN-IN)	4.68%	\$3.04	\$2.70	0	5.74	
5							
6	METHOD II						
7	(LIMITED BURN-IN)	3.42%	\$2.22	\$1.80	FREDDIE (1) (2) LSI'S	\$5.07	\$0.67/UNIT
8					TOTAL	\$1.05	
9	(THREE LSI'S)						
10							
11							
12	METHOD III						
13	(LIMITED BURN-IN)	2.59%	\$1.68	\$1.25	FREDDIE (1) (2) LSI, O.S. ROM (8) RAM (64)	\$4.81	\$0.93/UNIT
14					TOTAL	\$1.88	
15	(THREE LSI'S, O.S. ROM, RAM)						
16							
17							
18							
19							
20							
21							
22	NOTES:						
23	(1) WARRANTY REPAIR - LABOR AND MATERIAL @ \$65/UNIT (CONSOLE)						
24	(2) APPROX. 2% SAVINGS ON I.C. MATERIAL AND REPAIR LABOR COST DUE TO FULL IC BURN-IN.						
25	(3) IN-HOUSE BURN-IN COSTS TAKEN FROM JOE SPECHT'S PAM BURN-IN PROPOSALS DATED 5/26/82 AND 6/16/82.						
26	(NOTE: ONE MAY CONSIDER FIRST A DEVICE SAMPLE (I.E. 0.25% AQL) AND IF LOT DOES NOT PASS THEN PROVIDE FOR 100% BURN-IN.)						
27							
28							
29							
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32							
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38							

Date 11/16/83

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